



**FCC 47CFR part 15C
Test Report
For
Pulsar TX Module
Pre-Production Sample**

Reference Standard: FCC 47CFR part 15C
Manufacturer: Bowens International Limited
For type of equipment and serial number, refer to section 3
Report Number: 01-454/4535/2A/11
Supersedes Report Number: 01-454/4535/1/11
Report Produced by: -

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2. Summary of test results

The Pulsar TX Module Pre-Production Sample was tested to the following standards: -

FCC 47CFR Part 15C (effective date October 1st, 2010); Class DSR Intentional Radiator

Any compliance statements are made reliant on the modes of operation as instructed to us by the Manufacturer based on their specific knowledge of the application and functionality of the equipment tested. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard, particularly under different conditions to those during testing.

Title	Reference	Results
1. Conducted emissions	ANSI C63.4 §7.	Not Applicable ¹
2. Radiated emissions	ANSI C63.4 §8.	PASSED
3. Intentional radiator field strength	ANSI C63.10 §6.5.	PASSED
4. Occupied bandwidth and band edge	ANSI C63.10 §6.9.	PASSED
5. Frequency stability	ANSI C63.10 §6.8.	Not Applicable ²
6. Periodic operation and emissions	ANSI C63.10 §7.4. – 7.6.	PASSED

¹ EUT is powered from an internal battery.

² EUT is not operating in the 40.66 – 40.70 MHz band, therefore no limits are specified.

This report relates to the equipment tested as identified by a unique serial number and at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed.

Date of Test: 4th January 2011

Test Engineer:

Approved By:
Technical Director

Customer Representative:

3. Equipment Under Test (EUT)

3.1 Equipment Specification

Applicant	Bowens International Ltd 355 – 361 Old Road Clacton-on-Sea Essex CO15 3RH
Manufacturer of EUT	Bowens International Ltd
Brand name of EUT	Pulsar TX Module
Model Number of EUT	Pre-Production Sample
Serial Number of EUTs	C0001 N0002
Date when equipment was received by RN Electronics	4th January 2011
Date of test:	4th January 2011
Customer order number:	14447
Visual description of EUT:	Small plastic unit which has a sync connector on the side. The unit can be mounted onto a camera hot shoe.
Main function of the EUT:	To remotely trigger photographic flash equipment via 433MHz transmitter.
Height	39 mm
Width	54 mm
Depth	42 mm
Weight	0.06 g
Voltage	3V DC
Current required from above voltage source	10mA

3.2 EUT Configurations for testing

Frequency range	433.92MHz
Normal use position	Camera mounted
Normal test signals	Internally generated
Declared power level	<1mW
Declared channel bandwidth	Not Stated
Highest frequency generated / used	433.92MHz
Lowest frequency generated / used	16MHz

Serial # C0001 modified for continuous pulses.
Serial # N0002 normal manual operation.

3.3 EUT Modes

Mode	Description of mode	Used for Testing
Continuous TX	Unit continuously transmitting pulses.	YES
Normal	Unit manually triggered	YES

Description of ancillary equipment connected to the equipment under test, for the purpose of tests, can be found in Section 10.

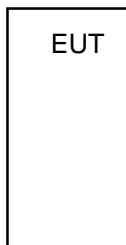
Any modifications made to the EUT, whilst under test, can be found in Section 11.

This report was printed on: 15 March 2011

3.4 Emissions Configuration

Test area

Outside test area



Unit in TX mode.

The EUT was powered via an internal battery and set to continuously transmit.

4. Specifications

The tests were performed by RN Electronics Engineer Lee Chandler who set up the tests, the test equipment, and operated it in accordance with the **R.N. Electronics Ltd** procedures manual, FCC Part 15 and those specifications incorporated by reference into 47CFR15 (e.g. ANSI C63.4-2003). In addition reference is made to ANSI C63.10-2009, where no other incorporated standard exists.

R.N. Electronics Ltd sites M and OATS are listed with the FCC. Registration Number 293246

4.1 Deviations

None.

4.3 Measurement Uncertainties

Parameter	Uncertainty
Transmitter Tests	
RF frequency	<± 0.7 ppm
Bandwidth	<± 1.9 %
Radiated RF Power	<± 3.5 dB
Radiated Spurious Emissions	<± 3.4 dB

5. Tests, Methods and Results

5.1 Conducted emissions

5.1.1 Test Methods

NOT APPLICABLE: EUT is powered from an internal battery.

5.3 Intentional radiator field strength

5.3.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.231b)

Test Method: ANSI C63.10, Reference (6.5)

5.3.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was scanned 1-4m in height in both Horizontal and Vertical polarisations. The EUT was rotated in all three orthogonal planes. The EUT was operated in Continuous TX mode.

5.3.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber.

Both the equipment and the antenna were rotated 360° to record the maximised emission.

5.3.2 Test results

Test Environment:

Temperature: 15°C Humidity: 43 %

Any Analyser plots can be found in Section 6.3 of this report.

Channel	Measured result	Duty cycle	Total
433.92MHz	PK (dBuV/m @3m)	adjustment (dB)	AVG (dBuV/m @3m)
Vertical	80.38	-46dB	34.38
Horizontal	82.64	-46dB	36.64

Note: EUT tested was pulsing, therefore peak measurements were made for ease of test. Duty cycle correction then applied per 47CFR15.35(c). TX on time in 100ms period. See section 5.5 Duty cycle within this report.

Limits: Average = 80.8dBuV/m @ 3m.

These results show that the EUT has **PASSED** this test.

5.3.2.1 Test Equipment used

E410, E411, E412, TMS933

See Section 10 for more details

5.4 Frequency stability

NOT APPLICABLE: EUT is not operating in the 40.66 – 40.70 MHz band, therefore no limits are specified.

5.5 Periodic operation and emissions

5.5.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.231a)

Test Method: ANSI C63.10, Reference (7.4 – 7.6)

5.5.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was operated in Continuous TX mode. For periodicity measurement a second EUT was operated in Normal mode.

5.5.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The centre frequency of the analyser was set to that of the transmitter, and the span set to zero. The sweep time was adjusted so that either the pulse width or the periodic operation could be observed.

Test site 'M' has been listed with the FCC.

5.5.2 Test results

Tests were performed using Test Site **M**.

Temperature of test Environment: 15°C

Analyser plots for the dwell time and duty cycle can be found in Section 6.4 of this report.

State	Result (ms)	Plot reference
TX on 100mS period	0.5	TX on time in 100ms
Repetition rate	None	Manual Operation

Limits:

15.231(a) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

These results show that the **EUT** has PASSED this test.

The duty cycle correction factor for peak to average emissions is therefore $20\log(0.5/100) = -46$ dB.

5.5.2.1 Test Equipment used

E410, E411, E412, TMS933

See Section 10 for more details.

5.6 Occupied bandwidth and band edge

5.6.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.231c)

Test Method: ANSI C63.10, Reference (6.9)

5.6.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was operated in Continuous TX mode.

5.6.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 3kHz RBW, 3x VBW, auto sweep time and max hold settings were used.

5.6.2 Test results

Tests were performed using Test Site **M**.

Temperature of test Environment: 15°C.

Analyser plots for the 20dB bandwidth can be found in Section 6.5 of this report.

Channel	Result	Plot reference
Single	150kHz	Occupied Bandwidth 3k

Limits: must be <0.25% of centre frequency.
 $0.25 \% F_c = 433.92\text{MHz} \times 0.0025 = 1.085\text{MHz}$.

Band edge compliance applies only to 40.66 – 40.70 MHz band.

These results show that the **EUT** has **PASSED** this test.

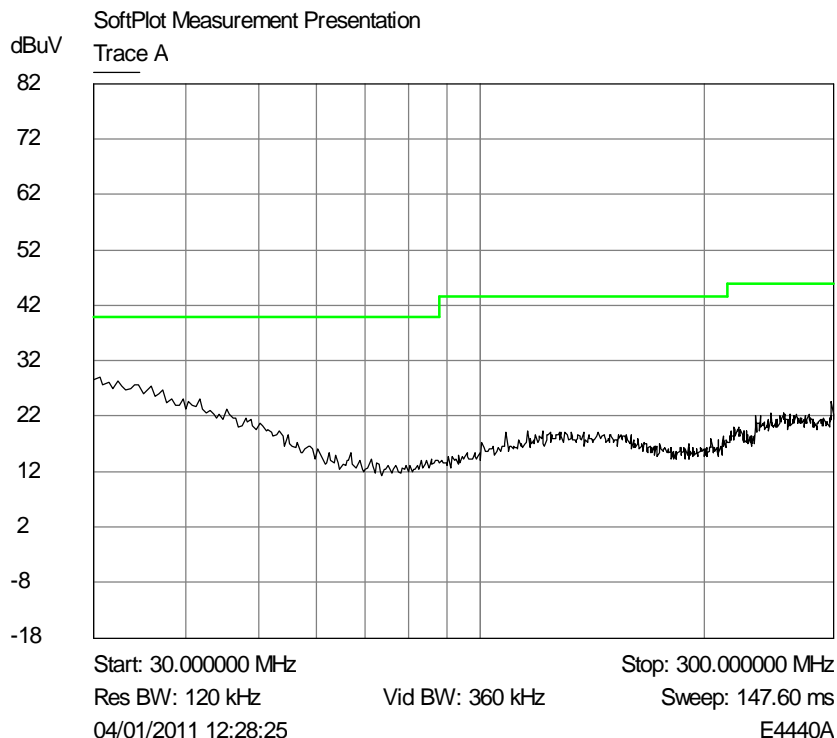
5.6.2.1 Test Equipment used

E410, E411, E412, TMS933

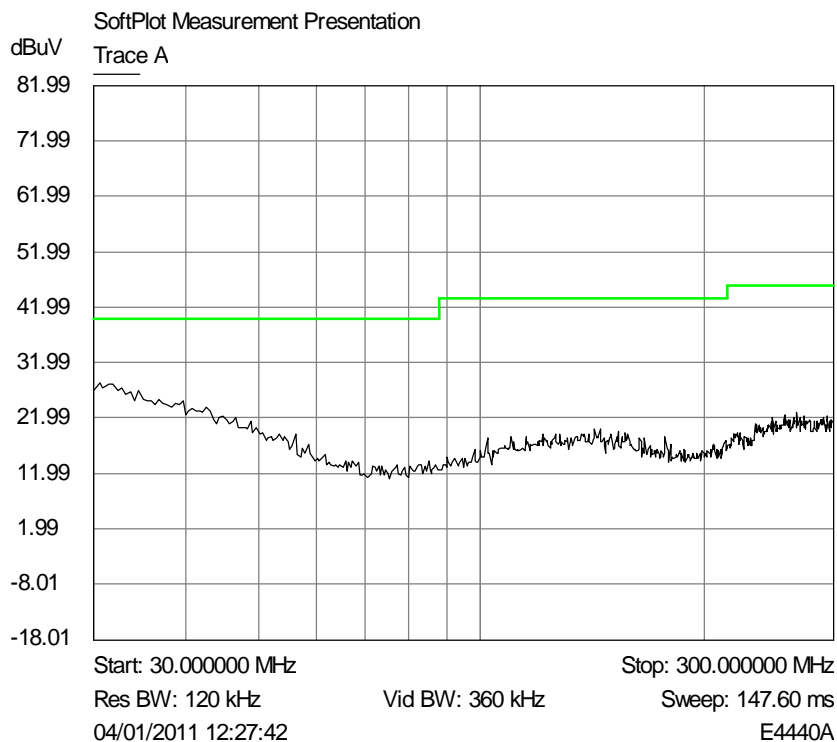
See Section 10 for more details.

6. Plots and Results

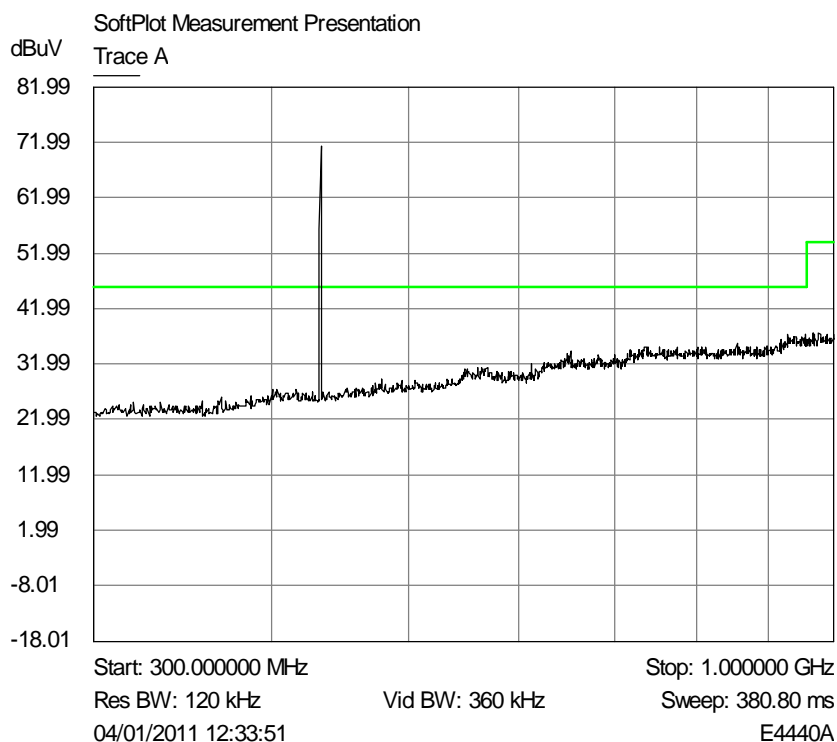
6.1 Radiated Emissions



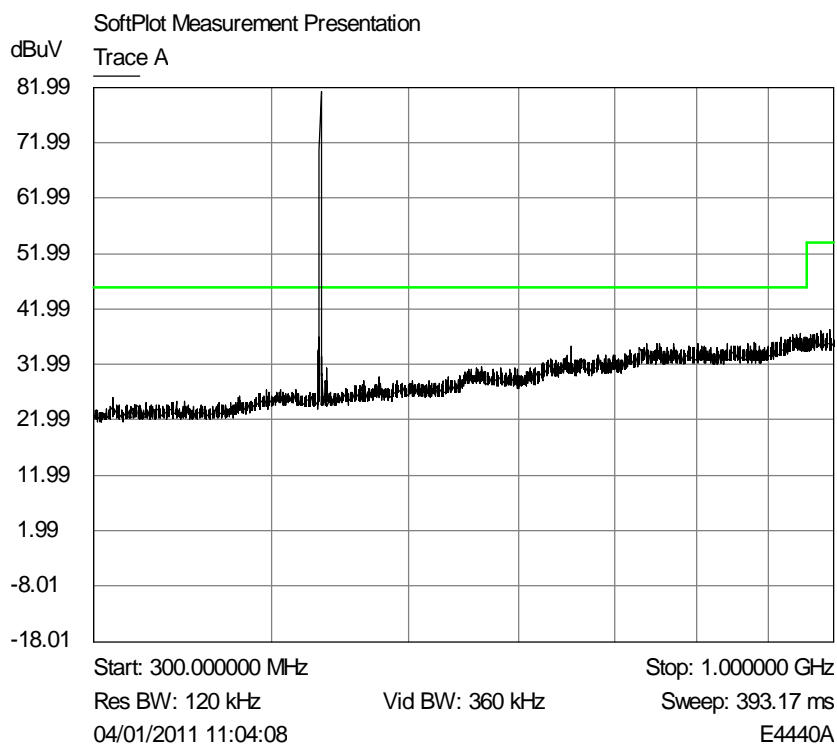
Plot of peak horizontal emissions 30MHz - 300MHz against the quasi-peak limit line.



Plot of peak vertical emissions 30MHz - 300MHz against the quasi-peak limit line.



Plot of peak horizontal emissions 300MHz - 1GHz against the quasi-peak limit line.



Plot of peak vertical emissions 300MHz - 1GHz against the quasi-peak limit line.

Table of signals measured below 1GHz.

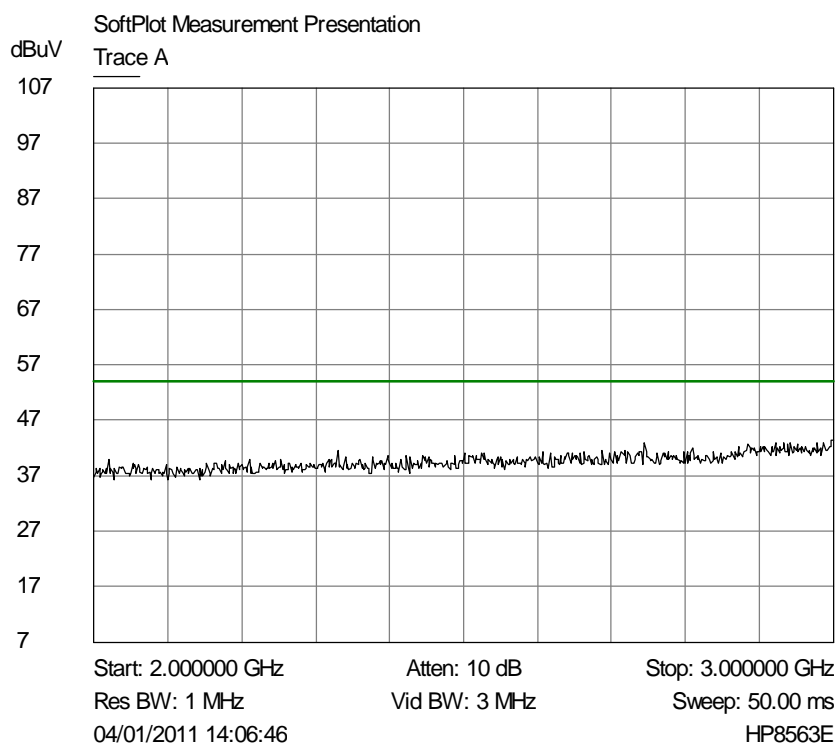
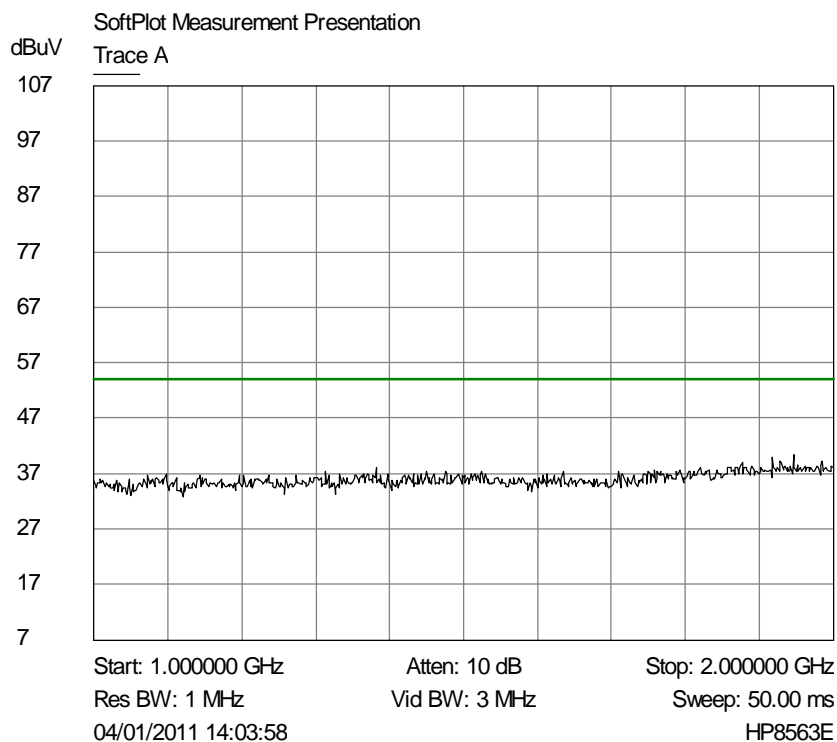
Horizontal

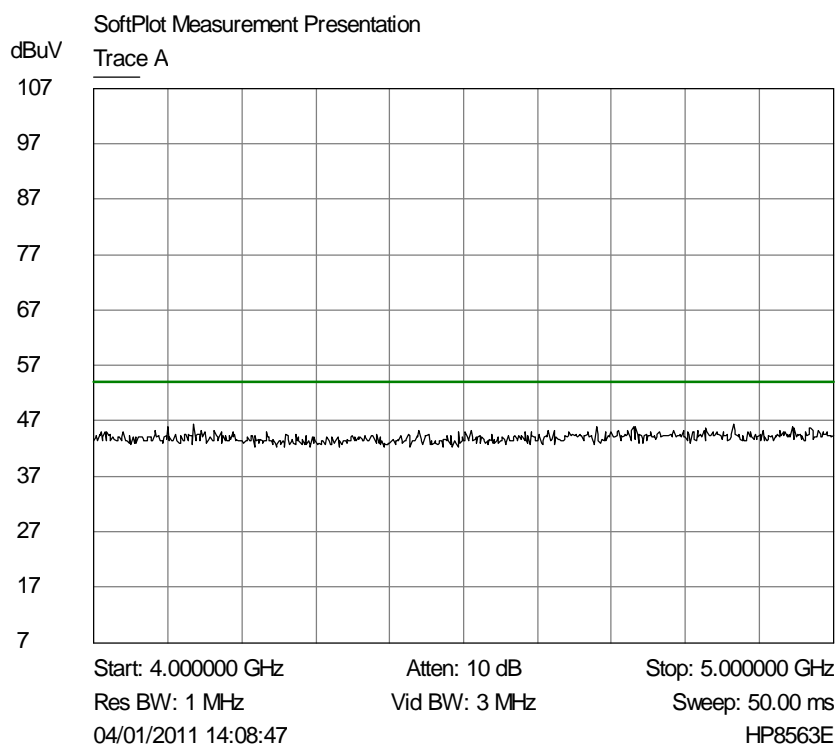
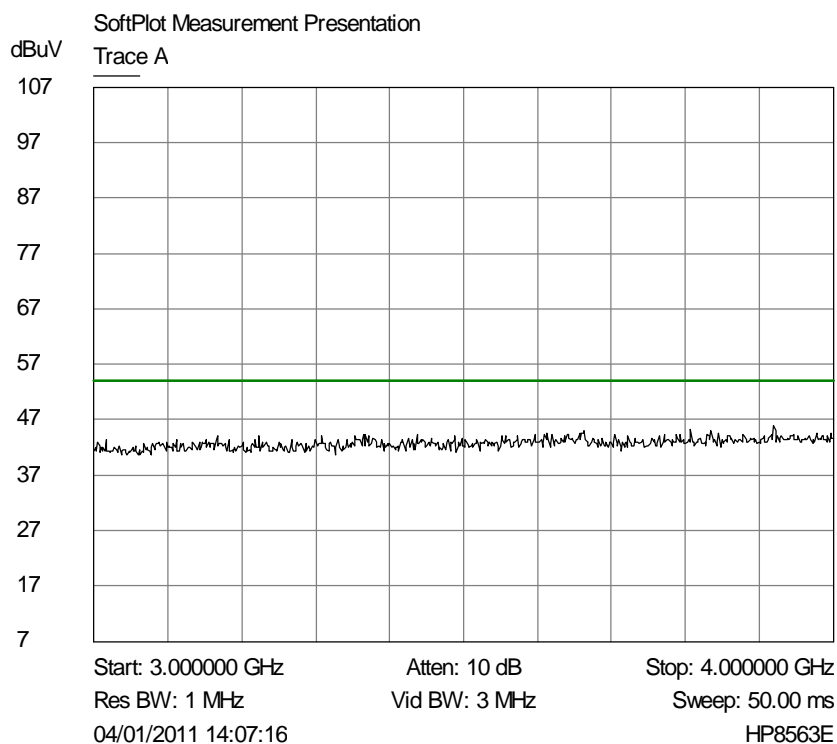
No Signals other than the Transmit signal.

Vertical

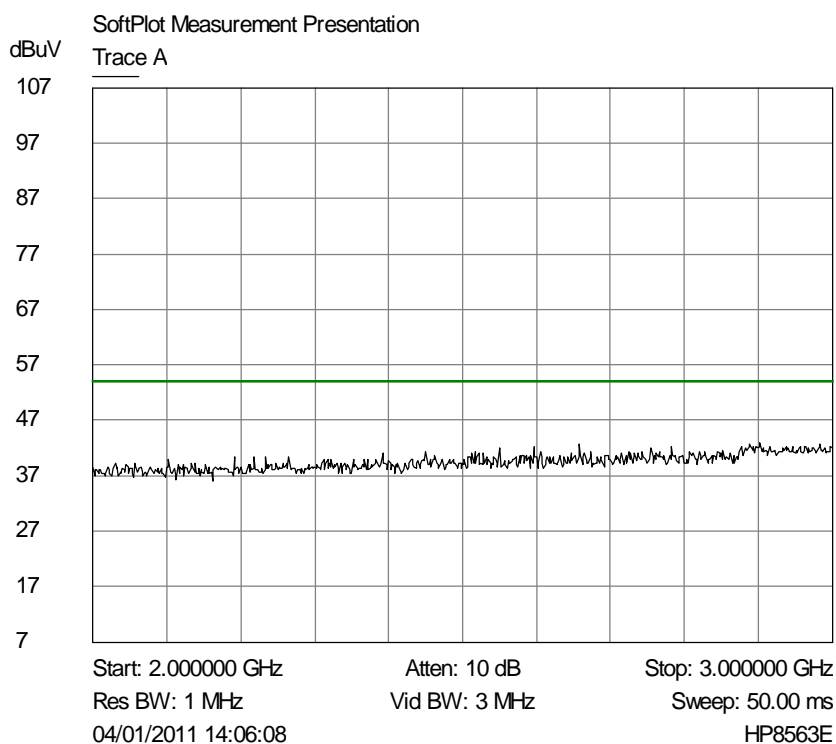
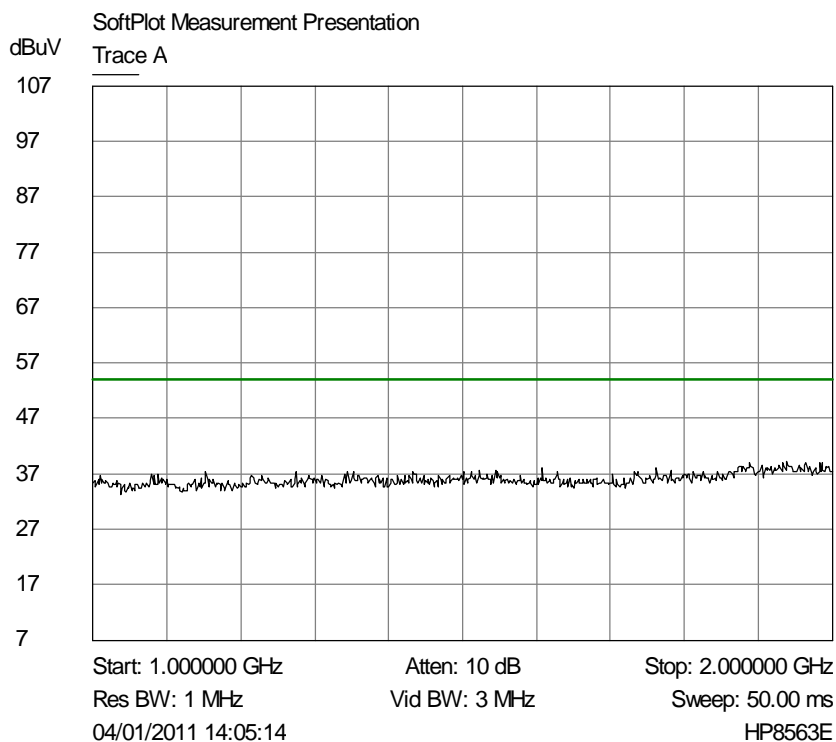
No Signals other than the Transmit signal.

Plots of Average horizontal emissions 1GHz - 5GHz against the Average limit line.





Plot of Average Vertical emissions 1GHz - 5GHz against the Average limit line.



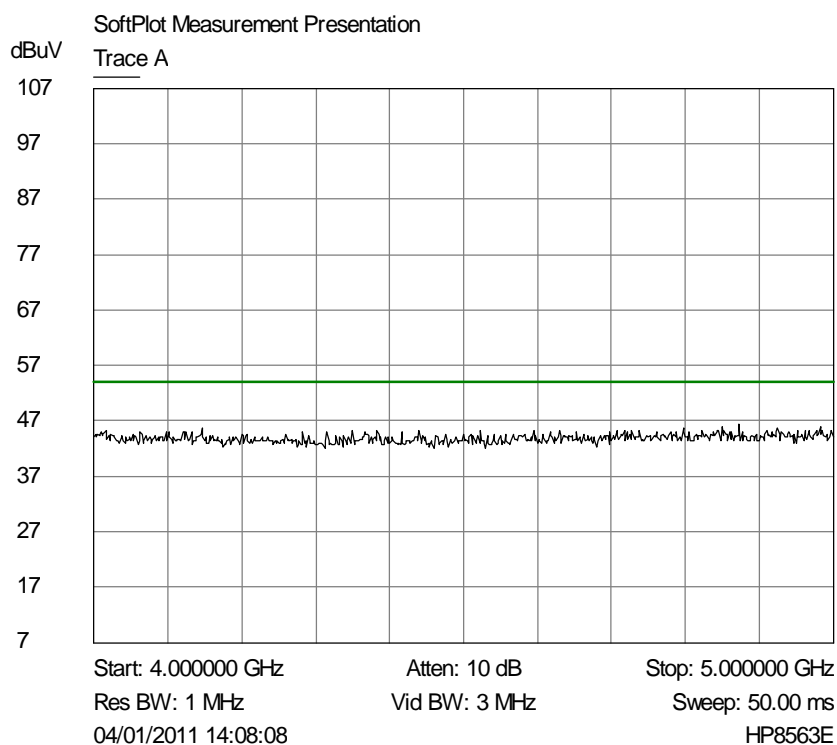
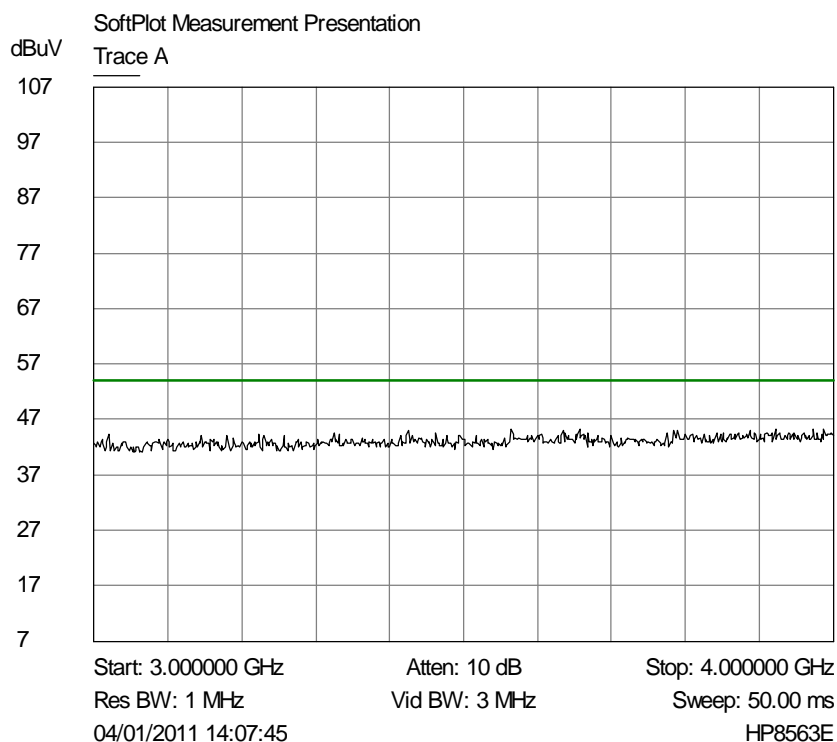


Table of signals measured above 1GHz.

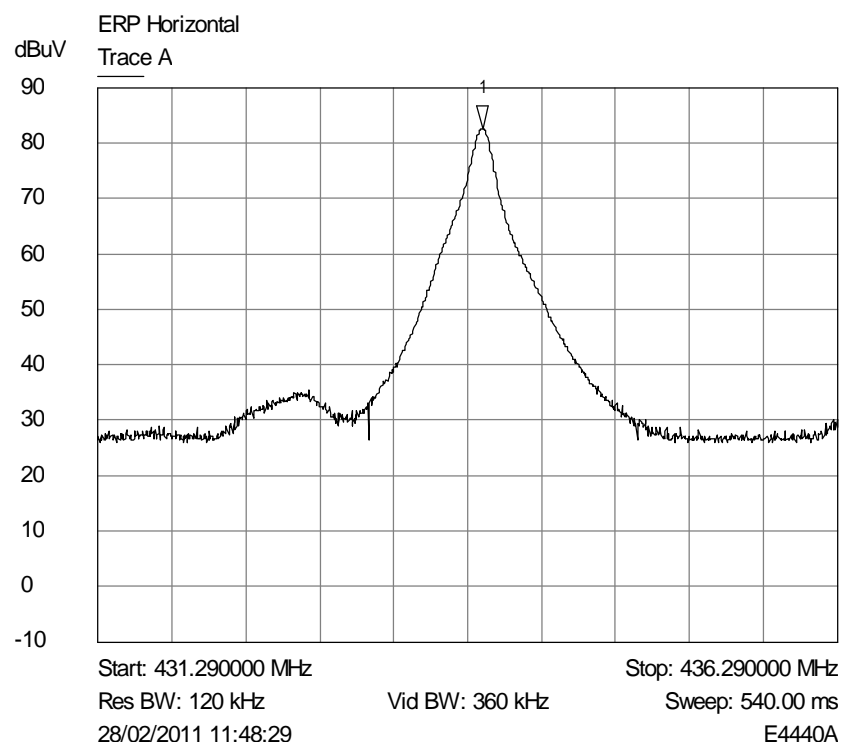
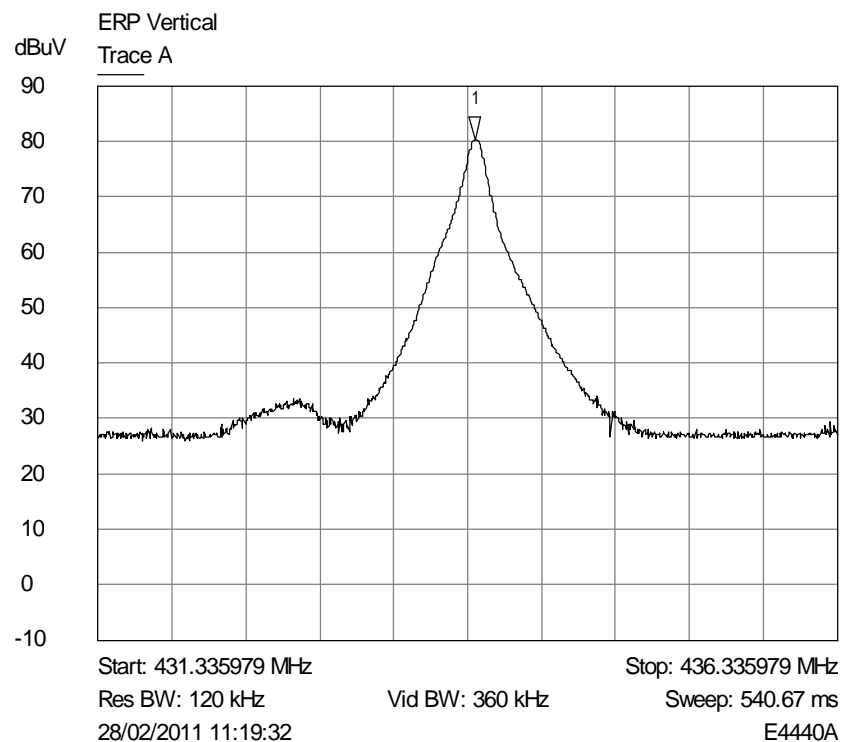
Horizontal

No Signals were found

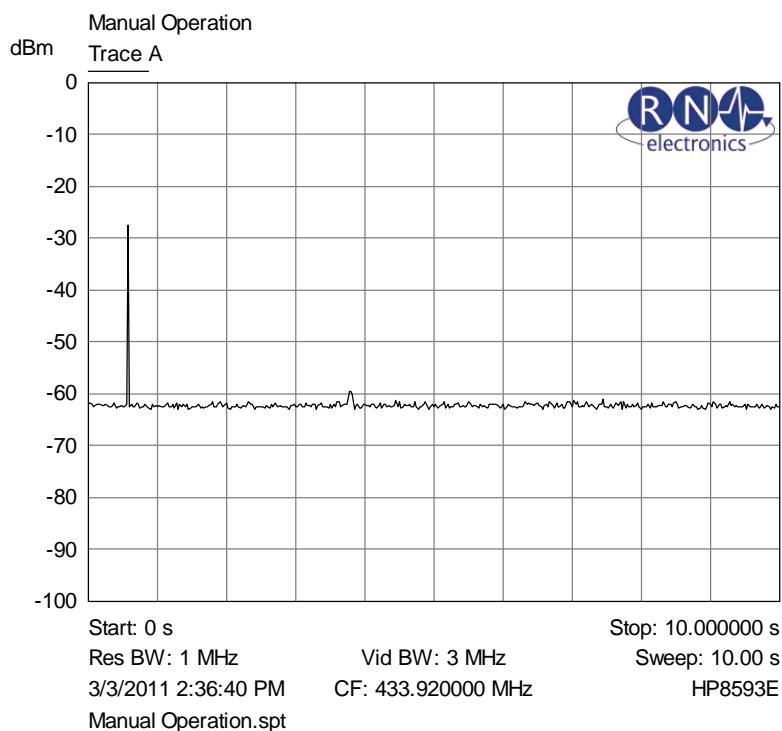
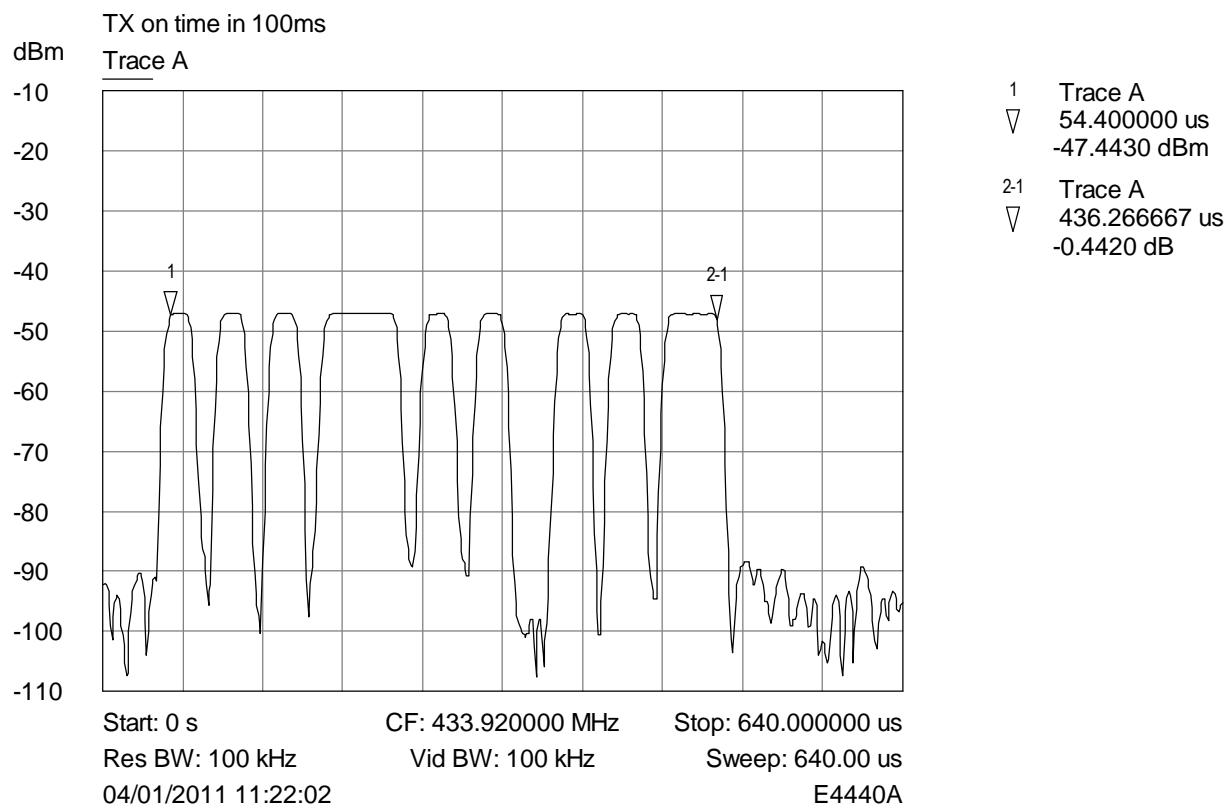
Vertical

No Signals were found

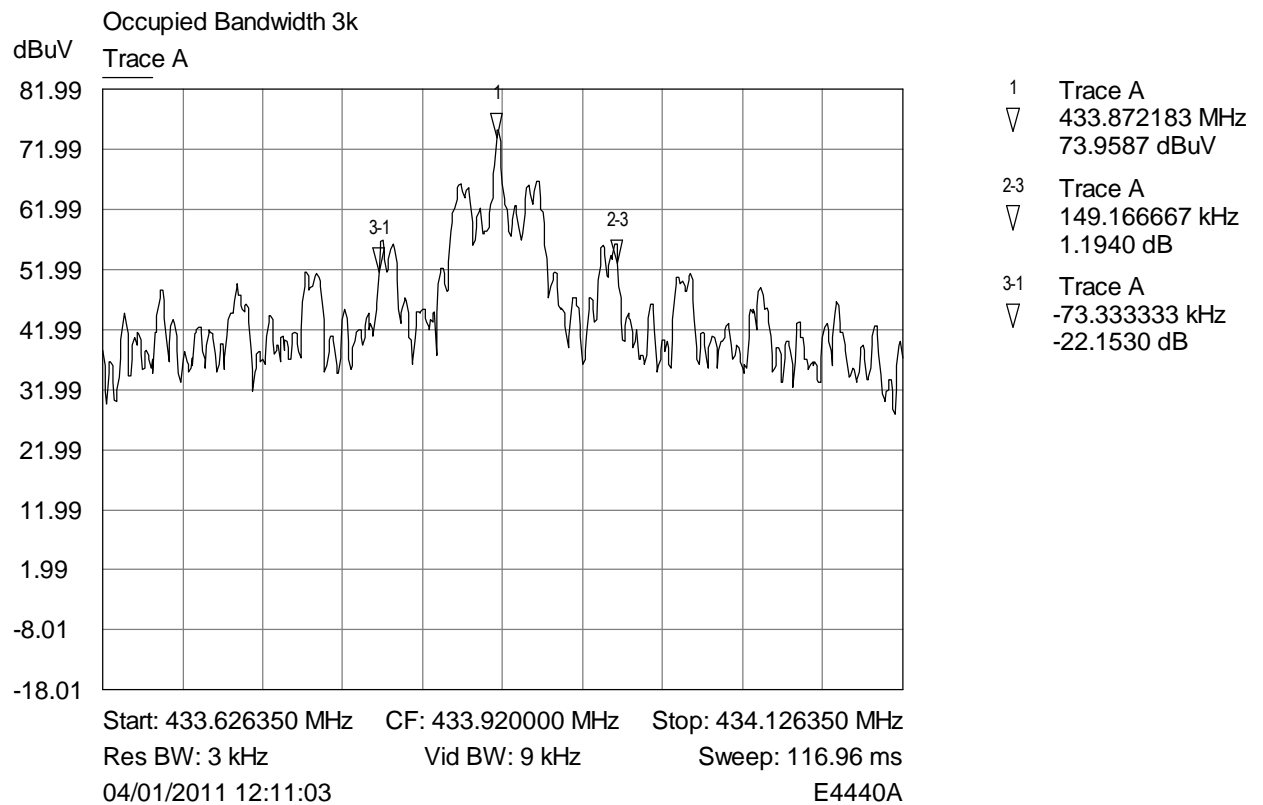
6.3 Fundamental Emissions



6.4 Duty Cycle and Periodicity



6.5 20dB Bandwidth



6.6 Band Edge Compliance

Not applicable. The EUT doesn't operate in the 40.66 – 40.70 MHz band.

7 Explanatory Notes

7.1 Explanation of FAIL LIMIT 1 Statement

The **FAIL MARGIN 1** statement(s) may appear on the graphical plots when the receiver used to measure your equipment detects a signal that exceeds the dashed line. This does not mean that the **EUT** has failed the test, only that the 10 dB calculation margin set, has been exceeded on a peak measurement.

Following the indication that the margin has been exceeded, measurements are made at the frequency (ies) of the peaks. These peaks have been calculated to either Quasi Peak or Average Peak dependant on the test. A table of results has been printed on the reverse of the page. This table looks similar to the one illustrated below: -

Signal Number	Frequency (MHz)	Peak (dBμV)	PK Delta L 1 (dB)	Avg (dBμV)	Av Delta L 1 (dB)
1	12345.0000	12.9	-2.5	10.2	-5.2

The First column, labelled Signal Number, is a number that the receiver has given to each signal, which has been calculated.

Column Two, labelled Frequency (MHz), is the frequency of the signal received.

Column Three, labelled Peak (dBμV), (can also be labelled, in the case of Quasi Peak, Peak dBμV/m) is the Level that was received at peak amount in dB above 1μV.

Column Four, labelled PK Delta L1 (dB), is the same level as Column three but is given in a level relative to the limit line required.

Column Five, labelled AVG (dBμV), (can also be labelled, in the case of Quasi Peak, QP dBμV/m) when undertaking a Quasi peak test, This is the Average or Quasi peak calculation results given in dBμV or dBμV/m above 1μV.

Column Six, labelled AV Delta L 1 (dB), (can also be labelled, in the case of Quasi Peak, QP Delta L 1 (dB)) is the Average or Quasi Peak calculation relevant to the limit line. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

7.2 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/m referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microVolt and may need to take account of any alternative measuring distance used. Examples:

- (a) limit of 500 μV/m equates to $20.\log(500) = 54 \text{ dB } \mu\text{V/m}$.
- (b) limit of 300 μV/m at 10m equates to $20.\log(300 \cdot 10/3) = 60 \text{ dB } \mu\text{V/m at 3m}$

7.3 Explanation of fundamental and harmonic limit calculations.

The limit at the frequency of interest is found by linearly-interpolating using the familiar slope-intercept formula, $y = mx + b$, re-written as follows:

$$\text{Limit} = \text{Lim}_{\text{lower}} + \Delta F[(\text{Lim}_{\text{upper}} - \text{Lim}_{\text{lower}})/(f_{\text{upper}} - f_{\text{lower}})]$$

Fundamental 433.92MHz:

$$\begin{aligned} \text{Limit} &= 3,750 + (433.92-260).[(12,500 - 3,750) / (470 - 260)] \\ &= 10,996.6\mu\text{V/m} \\ &= 80.0\text{dB}\mu\text{V/m} \end{aligned}$$

7.4 Explanation of average emission value calculations.

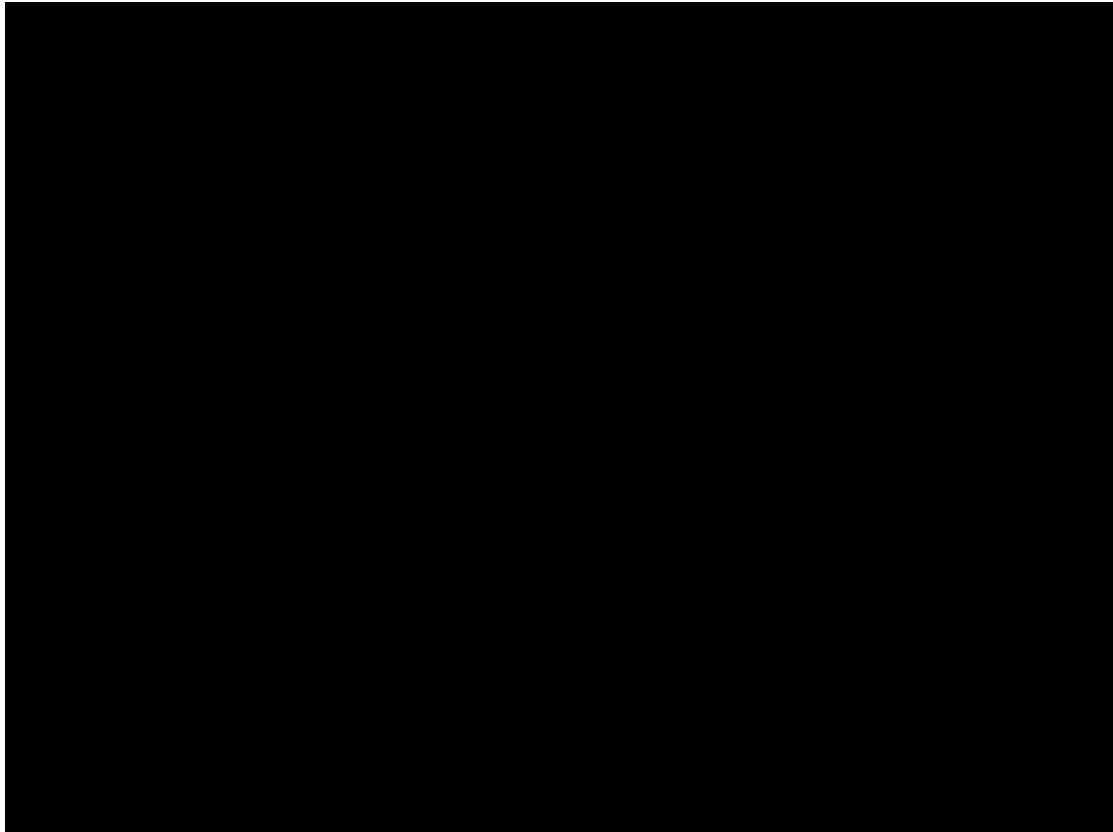
Duty cycle correction.

The average value of pulsed emissions has been calculated from the measured peak value using a correction factor:

$$20\log(0.5/100) = -46 \text{ dB.}$$

where 0.5 is the maximum time in ms that the pulse is on for during any 100ms.

8. Photographs



**Photograph of the EUT as viewed from in front of
the antenna, site M.**

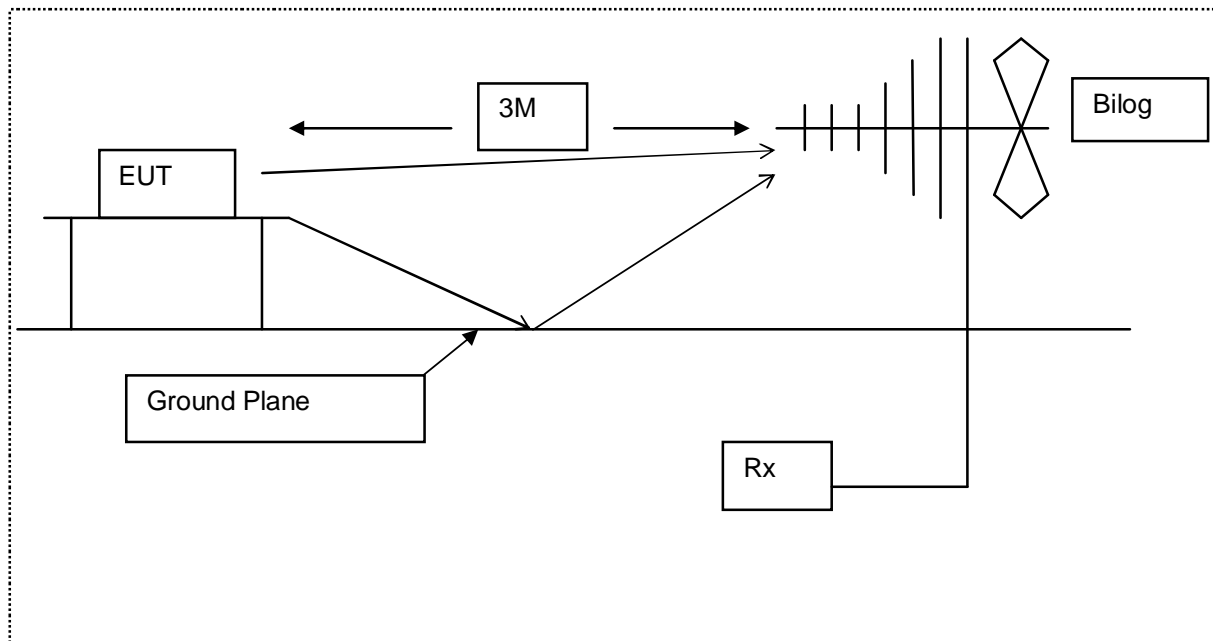
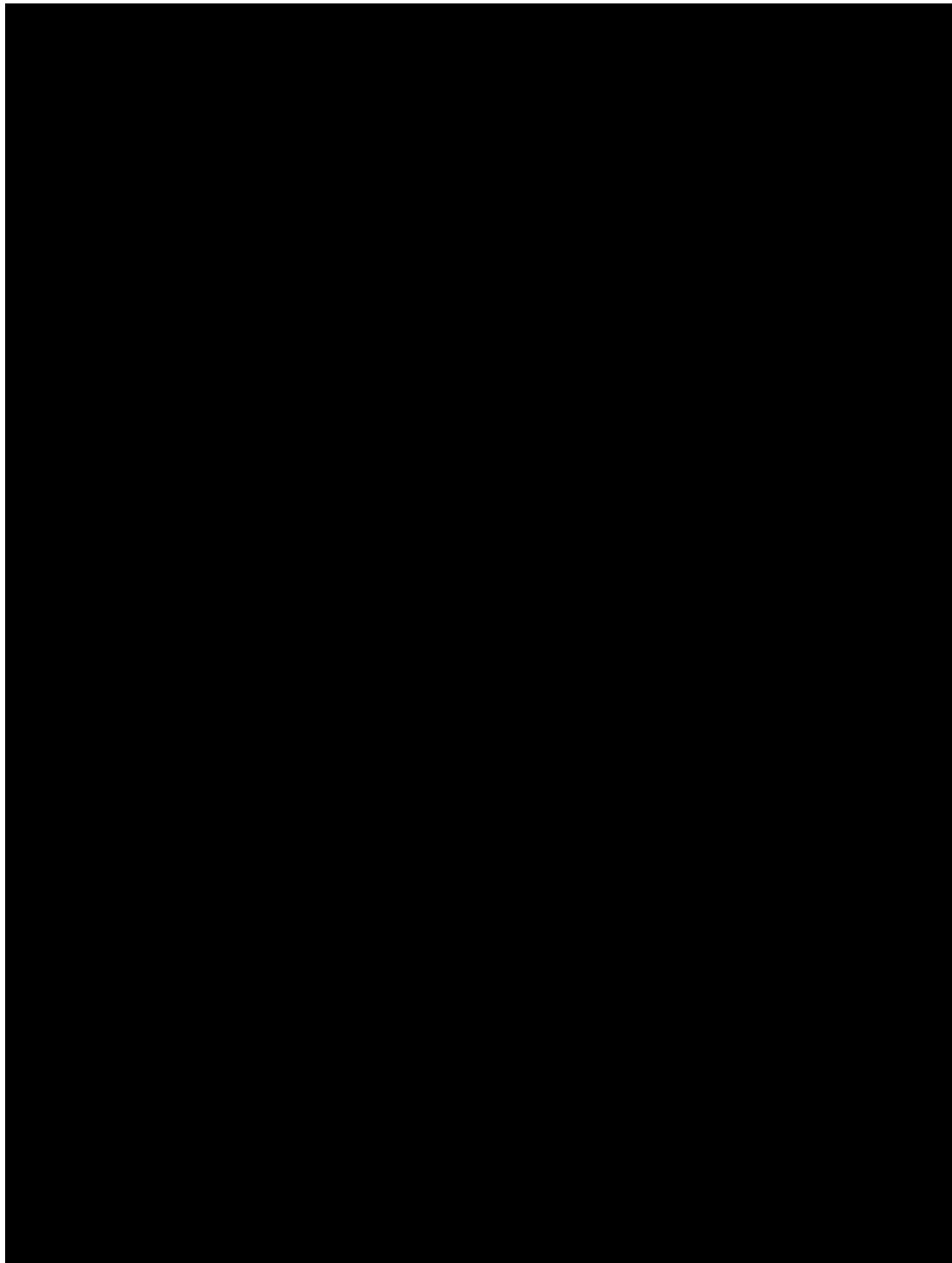


Diagram of the radiated emissions test setup.



Identifying Photograph of the EUT

9. Signal Leads

Port Name	Cable Type
Sync In	Screened Audio coax

10. Test Equipment Calibration list

The following table lists the test equipment used, last calibration date and calibration interval. All test equipment used has been maintained within the calibration requirements of **R.N. Electronics Ltd.** test facility quality system. Calibration intervals are regularly reviewed dependent on equipment manufacturer's recommendations and actual usage of the equipment.

RNNNo	Model	Description	Manufacturer	Date Calibrated	Period
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	02-Mar-09	60
E342	8563E	Spectrum Analyser 26.5 GHz	HP	23-Feb-09	24
E410	N5181A	3 GHz MXG Signal Generator	Agilent Technologies	06-Oct-10	12
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	05-Oct-10	12
E412	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	05-Oct-10	12
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	29-Oct-10	12
TMS933	CBL6141A	Bilog Antenna 30MHz - 2GHz	York EMC	09-Sep-10	36

11. Auxiliary equipment

11.1 Auxiliary equipment supplied by Bowens International Ltd

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

None.

11.2 Auxiliary equipment supplied by RN Electronics Limited

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

None.

12. Modifications

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

12.1 Modifications before test

There were no modifications made by R.N. Electronics Ltd before testing commenced. Serial no. C0001 was modified for continuous operation by Bowens International Limited.

12.2 Modifications during test

There were no modifications made by R.N. Electronics Ltd during testing.

13. Compliance information

Products subject to the Declaration of Conformity procedure are required to be supplied with a compliance information statement. A copy of this statement may be included here:

NOT APPLICABLE Certified Equipment

14 Description of Test Sites

Site A	Radio / Calibration Laboratory and anechoic chamber
Site B	Semi-anechoic chamber
Site B1	Control Room for Site B
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions) VCCI Registration No. C-2823
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-anechoic chamber (indoor OATS) FCC Registration No. 293246
Site Q	Fully-anechoic chamber
Site OATS	3m and 10m Open Area Test Site FCC Registration No. 293246 IC Registration No. 5612A-1 VCCI Registration No. R-2580

15 Abbreviations and Units

%	Percent
µV	microVolts
µW	microWatts
AC	Alternating Current
ALSE	Absorber Lined Screened Enclosure
AM	Amplitude Modulation
Amb	Ambient
ANSI	American National Standards Institute
°C	Degrees Celsius
CFR	Code of Federal Regulations
CS	Channel Spacing
CW	Continuous Wave
dB	decibels
dBµV	decibels relative to 1µV
dBc	decibels relative to Carrier
dBm	decibels relative to 1mW
DC	Direct Current
EIRP	Equivalent Isotropic Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FM	Frequency Modulation
FSK	Frequency Shift Keying
g	Grams
GHz	GigaHertz
Hz	Hertz
IF	Intermediate Frequency
kHz	kiloHertz
LO	Local Oscillator
mA	milliAmps
max	maximum
mbar	milliBars
MHz	MegaHertz
min	minimum
mm	milliMetres
ms	milliSeconds
mW	milliWatts
NA	Not Applicable
nom	Nominal
nW	nanoWatt
OATS	Open Area Test Site
OFDM	Orthogonal Frequency Division Multiplexing
ppm	Parts per million
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
Ref	Reference
RF	Radio Frequency
RTP	Room Temperature and Pressure
s	Seconds
Tx	Transmitter
V	Volts



Certificate of Test 4535/2

The equipment noted below has been tested by **R.N. Electronics Limited** and conforms with the relevant subpart of FCC 47CFR part 15, subject to deviations as detailed in this report.

This certificate relates to the unit, as identified by unique serial number(s) and further detailed in the referenced report, in the condition(s) at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Furthermore, this is a certificate of test only and should not be confused with an equipment authorisation.

Equipment:	Pulsar TX Module
Model Number(s):	Pre-Production Sample
Unique Serial Number(s):	C0001
Manufacturer:	Bowens International Ltd 355 Old Road Clacton-on-Sea Essex CO15 3RH
Customer Purchase Order Number:	14447
R.N. Electronics Limited Report Number:	01-454/4535/2A/11
Test Standards:	FCC 47CFR Part 15C: effective date October 1st 2010 , Class DSR Intentional Radiator
Date:	4th January 2011

For and on behalf of
R.N. Electronics Limited

Signature:



Notes:

QMF21J – 3: FCC PART 15C: RNE ISSUE 02: - JUN 10